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(54) [Title of the Invention] Electric Power Source Apparatus

(57) Abstract

[Object]

It is to provide an electric power source apparatus capable of controlling a plurality of apparatuses with needless of increasing the size and manufacturing cost of the electric power source apparatus.

[Means for Achieving the Object]

An AC voltage supplied from a commercially-available power source e is full-wave-commutated by a full wave rectifier 3 and then smoothed by a capacitor C3, field-effect transistors Q1 and Q2 are controlled by rectangular waves outputted from a

microcomputer 8, and an AC with a high-frequency is impressed to a fluorescent lamp in accordance with resonance properties of a choke coil L2 and a capacitor C7 to high-frequency-lighten the fluorescent lamp. An output from an inverter circuit 4 is altered by a control signal inputted to a signal input circuit 9. Since a control signal corresponding to the foresaid control signal is outputted from a signal output circuit 15 via a buffer circuit 16, it is needless to increase the current intensity to be applied to the control signal. Since, for example, a signal line for connection to be used by one apparatus can be shortened, distortion of signals and adverse influence due to the resistance of a signal line can be prevented from being caused, and the control by means of the control signal can be ensured.

[Claims]

[Claim 1]

An electric power source apparatus characterized by comprising;

a power conversion means for supplying power in a power-changeable manner to a load circuit,

a signal input means for inputting a control signal that fixes a power of the power conversion means, and

a signal output means including a buffer means and outputting a control signal corresponding to the control signal having been inputted to the signal input means through the buffer means.

[Claim 2]

An electric power source apparatus according to claim 1, wherein the signal output means includes an output wave form commutation means.

[Claim 3]

An electric power source apparatus according to claim 1 or claim 2, characterized by further comprising,

an abnormality detection means for detecting abnormality, and

a discontinuing means for discontinuing a control signal outputted from the signal output means when abnormality is detected by the abnormality detection means.

[Claim 4]

An electric power source apparatus according to claim 3, characterized by further comprising an informing means for informing abnormality upon detection of abnormality by the abnormality detection means.

[Claim 5]

An electric power source apparatus according to claim 4, characterized in that the load circuit includes a lamp and the informing means causes the lamp to lighten it in a different manner from the normal lighting manner.

[Detailed Explanation for the Invention]

[0001]

[Field of the Invention]

The present invention relates to an electric power source apparatus capable of changing its power by means of a control signal to produce electric power.

[0002]

[Prior Art]

Up till now, as this sort of electric power source apparatus, a discharging lamp lighting apparatus as shown in FIG. 7 has been known, for example.

[0003]

In this charging lamp lighting apparatus 1 shown in FIG. 7, a filter circuit 2 is connected to a commercially-available AC power source e, and this filter circuit 2 has a capacitor C1, a common mode choke L1 and a capacitor C2 and is connected with an input terminal of a full wave rectifier 3 comprising a diode bridge as a commutating means.

[0004]

Further, a capacitor C3 for smoothing use is connected to an output terminal of the full wave rectifier 3, and an inverter circuit 4 of the half bridge type is connected to the capacitor 3, the inverter circuit 4 includes a series circuit

consisting of a field-effect transistor Q1 and a field-effect transistor Q2.

[0005]

The inverter circuit 4 is controlled by a control circuit 5, and the control circuit 5 is controlled by an external dimmer 6. To the control circuit 5, a series circuit consisting of resistances R1 and R2 for voltage division use is connected so as to be in parallel to the capacitor C3, and a Zener diode ZD1 for constant voltage use and a capacitor for smoothing use are also connected so as to be in parallel to the resistance R2, to configure a constant voltage source 7 with a power of, for example, 12V, and the constant voltage source is connected to a Vcc terminal of a microcomputer 8 for control use.

[0006]

The external dimmer 6 is connected to a signal input circuit 9 as a signal inputting means, and an input terminal of a full wave rectifier 10 for preventing erroneous polarity connection is connected to the signal input circuit 9 via a resistance R3. A parallel circuit consisting of a resistance R4 and a light emitting diode LED1 is connected to an output terminal of the full wave rectifier 10. To the light emitting diode LED1, a phototransistor Q3 is photocoupled. The phototransistor Q3 is connected to a Vref terminal for 5V and a GND terminal of the microcomputer 8 through a resistance R5, and an emitter of the phototransistor Q3 is connected to a PWM terminal through the diode D1. Further, a series circuit consisting of resistances R6 and R7 is connected to between the Vref terminal and GND terminal of the microcomputer 8, the emitter of the phototransistor Q3 is connected to a connection

point of the resistances R6 and R7 through a series circuit consisting of a diode D2 and a resistance R8, the connection point of the resistances R6 and R7 is connected to a Vcom terminal through a resistance R9, and a capacitor C5 is connected to between the Vcom terminal and the GND terminal.

[0007]

Further, a V01 terminal is connected to a gate of the field-effect transistor Q1, and a V02 terminal is connected to a gate of the field-effect transistor Q2.

[0008]

Further, a load circuit 11 is connected to the field-effect transistor Q2. This load circuit 11 is connected to one end of filaments FL1, FL2 of a fluorescent lamp FL as a charging lamp locating between a drain and a source of the field-effect transistor Q2 through a choke coil L2 and a capacitor C6 for cutting AC, and a capacitor C7 for resonance use is connected to the other ends of the filaments FL1 and FL2.

[0009]

Further, as shown in FIG. 8, several tens more or less charging lamp lighting apparatuses 1 are wired by multi-drop wiring to the external dimmer 6.

[0010]

In the charging lamp lighting apparatus, an AC voltage supplied from the commercially-available AC power source e is full-wave-commutated by the full wave rectifier and then smoothed by the capacitor C3. Then, rectangular waves are outputted from the microcomputer 8 to control the field-effect transistors Q1 and Q2, and high-frequency AC is impressed to the fluorescent lamp FL in accordance with the resonance

properties of the choke coil L2 and the capacitor C7 so that the fluorescent lamp is high-frequency-lightened.

[0011]

Further in the charging lamp lighting apparatus, a control signal for controlling PWM is outputted from the external dimmer 6, a commutation is performed so that no erroneous polarity connection is caused in the full wave rectifier 10 and no problem is caused even when being connected to any polarity, the light emitting diode LED1 is caused to emit light when an H-level signal is inputted, the phototransistor Q3 is turned on when the light emitting diode LED1 emits light, and the capacitor C3 is charged to impress a voltage of the capacitor C3 to a Vcon terminal. When the voltage impressed to the Vcon terminal is high, the microcomputer 8 causes turning-on and off operations of the field-effect transistors Q1 and Q2 so that the frequency of the inverter circuit 4 becomes high, whereby the power of the inverter circuit 4 is lowered.

[0012]

That is, higher the on-duty of PWM control signal, lower the power of the inverter circuit 4, and in contrast, lower the on-duty of the PWM control signal, higher the power of the inverter circuit 4.

[0013]

Further, the charging lamp lighting apparatus is configured such that the operation of the inverter circuit 4 is discontinued when a voltage to be inputted to the PWM terminal has exceeded a threshold value to thereby extinguish the fluorescent lamp FL.

[0014]

However, although it is possible to connect the several tens more or less charging lamp lighting apparatuses to the one external dimmer 6 as described above, it is necessary to increase the current intensity to be applied to the external dimmer 6 or to use a plurality of external dimmers 6 to thereby control the overall charging lamp lighting apparatus 1 when it is desired to control the charging lamp light apparatuses of which number being more than said several tens, which leading the size of the apparatus larger and the production cost more expensive.

[0015]

Further, for example, when several hundreds charging lamp lighting apparatus 1 are connected to one external dimmer 6, a signal amplifier 12 is connected to the external dimmer 6, and the external dimmer is connected to the charging lamp lighting apparatuses through the signal amplifier 12.

[0016]

Whereas, when the number to be connected of the charging lamp lighting apparatuses is increased, the channel of the signal line is caused to be long, resulting in an increased static capacity that causes distortion of signal wave forms, and influence resulted from considerably-increased resistance of the signal line and contact resistance due to increased signal power causes deterioration of signal voltage to disable the charging lamp lighting apparatus form operating normally.

[0017]

Further, in case that short-circuit wiring was established at the time of the execution, the charging lamp lighting apparatus 1 will not operate normally, and it is difficult to find the point that is abnormal. Accordingly, there is a fear

of flowing of excess current into the external dimmer 6 to give damage thereto.

[0018]

[Object to be achieved by the Invention]

As described above, although several tens charging lamp lighting apparatuses 1 may be connected to one external dimmer 6 as shown in FIG. 8, when the charging lamp lighting apparatuses exceeding that number are required to be controlled, it is necessary to increase the current intensity to be applied to the external dimmer 6 or to use a plurality of external dimmers in order to control the overall charging lamp lighting apparatuses, thus resulting in enlargement in the size of the dimmer or increase in the cost.

[0019]

Alternatively, as shown in FIG. 9, if the external dimmer 6 is connected with the signal amplifier 12 and is further connected to the charging lamp lighting apparatuses of more than the foresaid number through the signal amplifier 12, such a problem that the channel of the signal line needs to be long, thus causing an increased static capacity to distort the wave forms of the signals, or the influence resulting from the resistance of the signal line and the contact resistance due to increased signal power becomes not being negligible, then causing deterioration of the signal voltage which disable the normal operation may arise.

[0020]

The present invention was attempted to solve the above-mentioned problems, and it is an object of the present invention to provide an electric power source apparatus capable

of controlling a plurality of apparatuses with needless of enlarging the electric power source apparatus in the size and increasing the manufacturing cost.

[0021]

[Means for achieving the Object]

The electric power source apparatus according to claim 1 comprises a power conversion means capable of changeably supplying power to a load circuit, a signal input means for inputting a control signal that fixes a power of the power conversion means, and an signal output means having a buffer means and outputting a control signal corresponding to the control signal having been inputted into the signal input means via the buffer means,

characterized in that it is needless to use a current with a greater intensity for a control signal since the apparatus changes the power supplied from the power conversion section in response to a control signal having been inputted to the signal input means and also outputs a control signal corresponding to the control signal having been inputted to the signal input means from the signal output means via the buffer means, and it is possible to prevent the signals from being distorted and negative effects such as resistance of the signal line from being occurring to thereby ensure the control of the apparatus by means of the control signals since the signal line used by one apparatus for the connection can be shortened, for example.

[0022]

The electric power source apparatus according to claim 2 is similar to the apparatus as defined in the claim1, wherein the signal output means includes an output wave form commutation

means. With this electric power source apparatus, the control signals are made accurate and the control by means of the control signals can be ensured.

[0023]

The electric power source apparatus according to claim 3 is similar to the apparatuses as defined in the claims 1 and 2, wherein an abnormality detection means for detecting abnormality and a discontinuing means for discontinuing the control signals outputted from the signal output means upon detection of abnormality in the abnormality detection means are further included. With this electric power source apparatus, since the discontinuing means causes the signal output means to discontinue the output of the control signals when abnormality has detected by the abnormality detection means, the operation of the apparatus during the abnormal state can be prevented.

[0024]

The electric power source apparatus according to claim 4 is similar to the apparatus as defined in the claim 3, wherein an informing means for informing abnormality upon detection of abnormality in the abnormality detection means is further included. With this electric power source apparatus, the abnormality can be easily recognized by the informing means when abnormality has been caused.

[0025]

The electric power source apparatus according to claim 5 is similar to the apparatus as defined in the claim 4, wherein the load circuit has a lamp additionally, and the informing means causes the lighting state of the lamp to be different from the normal lighting state so that the abnormality can be easily

recognized with the lamp in the load circuit.

[0026]

[Embodiments]

Now, a lighting apparatus according to an embodiment for the present invention will be explained with referring to the appended drawings. Note that the parts explained in the example for the conventional apparatus shown in FIGS. 7 to 9 will be used with the same reference signs in the following description.

[0027]

In the charging lamp lighting apparatus 1 shown in FIG. 1, a filter circuit 2 is connected to a commercially-available AC power source e, and the filter circuit 2 includes a capacitor C1, a common mode choke L1 and a capacitor C2 and is connected with an input terminal of a full wave rectifier 3 comprising a diode bridge as a commutation means.

[0028]

Further, a capacitor C3 for the smoothing use is connected to the output terminal of the full wave rectifier 3, the capacitor C3 is connected with an inverter circuit 4 as a power conversion means of the half-bridge type, and the inverter circuit 4 includes a series circuit consisting of the field-effect transistors Q1 and Q2.

[0029]

The inverter circuit 4 is controlled by a control circuit 5, and the control circuit 5 is controlled by an external dimmer 6. The control circuit 5 is connected with a series circuit consisting of resistances for pressure division use R1 and R2 so as to be in parallel to the capacitor C3, and a Zener diode ZD1 and a capacitor C4 for smoothing use are connected in parallel

to the resistance R2 to configure a constant voltage source 7, for instance with a power of 12V, which is connected to a Vcc terminal of a microcomputer 8 for control use.

[0030]

Besides, the external dimmer 6 is connected to a signal input circuit 9 as a signal input means, and the signal input circuit 9 is connected with an input terminal of a full wave rectifier 10 for prevention of erroneous polarity connection use through a resistance R3. To an output terminal of the full wave rectifier 10, a series circuit consisting of a resistance R4, and light emitting diodes LED 1 and LED 2 is connected in parallel. Then, a phototransistor Q3 is photocoupled to the light emitting diode LED 1, the phototransistor Q3 is connected to both an Vref terminal and a GND terminal of the microcomputer 8 with a power of 5V through a resistance R5, and an emitter of the phototransistor Q3 is connected to a PWM terminal through a diode D1. Further, a series circuit consisting of resistances R6 and R7 is connected between the Vref terminal and GND terminal of the microcomputer 8, the emitter of the phototransistor Q3 is connected to a connection point of the resistances R6 and R7 through a series circuit consisting of a diode D2 and a resistance R8, the connection point of the resistances R6 and R7 is connected to a Vcom terminal through a resistance R9, and a capacitor C5 is connected to between the Vcom terminal and the GND terminal.

[0031]

Further, a V01 terminal is connected to a gate of the field-effect transistor Q1, and a V02 terminal is connected to a gate of the field-effect transistor Q2.

[0032]

Further, a signal output circuit 15 as a signal output means is connected to between both terminals of the capacitor 4 in the constant voltage source 7, the signal output circuit15 is connected in series with the phototransistor Q4 that is photocoupled with a resistance R10 and a light emitting diode LED2 to configure a buffer circuit 16 as a buffer means, and a base and a collector of a transistor Q5 is connected to a collector and an emitter of the phototransistor Q4.

[0033]

Further, the field-effect transistor Q2 is connected with the load circuit 11. The load circuit 11 is connected to one end of each of filaments FL1 and FL2 of a fluorescent lamp as a charging lamp in a region between the drain and source of the field-effect transistor Q2 through a choke coil L2 and a capacitor C6 for DC cut use, and the other end of each of the filaments FL1 and FL2 is connected with a capacitor C7 using for preliminarily heating the filaments FL1 and FL2 and for resonance.

[0034]

Further, as shown in FIG. 2, a signal input circuit 9 in the charging lamp lighting apparatus 1 is connected to the external dimmer 6, a signal output circuit 15 in the charging lamp lighting apparatus 1 is connected to a signal input circuit 9 in the next charging lamp lighting apparatus 1, and such a connection is repeated for the subsequent charging lamp lighting apparatuses in turn to thereby forming connections of the charging lamp lighting apparatuses in series.

[0035]

Now, the operations in the above-described embodiment will be explained in the following.

[0036]

First of all, an AC voltage supplied from a commercially-available AC power source e is full-wave-commutated by the full wave rectifier 3 and then smoothed by the capacitor C3, the field-effect transistors Q1 and Q2 are controlled by rectangular waves outputted from the microcomputer 8, and AC with a high frequency is impressed to a fluorescent lamp FL in accordance with the resonance properties of the choke coil L2 and the capacitor C7 to thereby high -frequency-lighten the fluorescent lamp FL.

[0037]

Following thereto, a control signal for PWM is outputted from the external dimmer 6 and then commutated in order to prevent the signal from being damaged even connecting to either polarity so that no erroneous polarity connection is caused in the full wave rectifier 10, the light emitting diode LED1 is caused to emit light when an H-level signal is inputted, the phototransistor Q3 is turned on when the light emitting diode LED1 has emitted light, a voltage of the capacitor C3 is pressure-divided through the resistances R5 to R8, then current-limited by the resistance R9, and smoothed by the capacitor C3 to thereby be impressed to the Vcon terminal. Besides, if the voltage to be impressed to the Vcon terminal is high, the microcomputer 8 causes the field-effect transistors Q1 and Q2 to perform on/off switching operations so that the frequency in the inverter circuit 4 to be high, whereby the output of the inverter circuit 4 is lowered. The inverter circuit 4

cause changes in the switching frequencies of the field-effect transistors Q1 and Q2 to thereby change the resonance properties of the choke coil 12 and the capacitor C7 in order to execute dimming of the fluorescent lamp.

[0038]

That is, the average voltage comes to 12V and the output of the inverter circuit 4 is lowered to the lowest when the on-duty of the control signal for PWM is large as much as 100%, while the average voltage comes to 0V and the output of the inverter circuit 4 becomes large to the maximum degree when the on-duty is small as much as 0%.

[0039]

Further, the light emitting diode LED2 emits light simultaneously to the light emission of the light emitting diode LED1, the phototransistor Q4 is turned on, followed by turning on of the transistor Q5, and a signal identical to the control signal for PWM inputted to the signal input circuit 9 in the charging lamp lighting apparatus 1 is outputted from the signal output circuit 15 and inputted to a signal input circuit 9 in the next charging lamp lighting apparatus 1. Note that, since a control signal with a small current sufficient to only the next charging lamp lighting apparatus 1 is outputted through the buffer, no amplifier will be required and setting a limitation for the load capacity will be needless. Further, since the signal line to the next charging lamp lighting apparatus 1 is not directly electrically-connected to the previous charging lamp lighting apparatus 1 and the control signal is boosted, that is current-amplified, by newly using the constant voltage source 7 as the power source and is outputted

to the next charging lamp lighting apparatus 1, the deterioration of the control signal may be compensated, and the control signal can be sent in turn without increasing the intensity of a current to be applied to the signal. As a result, resistance of the signal line and contact resistance may not be problematic, and no distortion is caused in the control signal. Therefore, the charging lamp lighting apparatuses can be controlled by one external dimmer 6 irrespective of the number thereof

[0040]

Further, it is configured such that, when the voltage to be inputted to the PWM terminal exceeds a threshold value, the operation of the inverter circuit 4 is discontinued to extinguish the fluorescent lamp FL.

[0041]

Now, the other embodiment will be explained in the following with referring to FIG. 3.

[0042]

The charging lamp lighting apparatus 1 shown in FIG. 3 is configured such that, in the charging lamp lighting apparatus 1 shown in FIG. 1, an emitter of the phototransistor Q4 in the buffer circuit 16 is connected to a non-inverting input terminal of a comparator 17 as a wave form commutation means, and an inverting input terminal of the comparator 17 is connected to the constant voltage source 7 and an output terminal of the comparator 17 is connected to a base of the transistor Q6.

[0043]

Then, though the basic operations are similar to those for the charging lamp lighting apparatus 1 shown in FIG. 1, the light emitting diode LED2 emits light when the control signal

to be inputted to the signal input circuit 9 is at an H-level, the phototransistor Q4 is turned on, the comparator 17 outputs only when the transistor Q4 has been turned on during which the voltage at the non-inverting input terminal becomes higher than the reference voltage at the inverting input terminal, the signal output circuit 15 outputs Vcc being at an H-level, the light emitting diode LED2 emits no light when the control signal is at an L-level, the phototransistor Q4 is not turned on, the comparator 17 does not output when the phototransistor Q4 has been turned off during which the voltage at the non-inverting input terminal becomes lower than the reference voltage at the inverting input terminal, the signal output circuit 15 outputs 0V being an L-level, and the control signal corresponding to the control signal having been inputted to the signal input circuit 9 is outputted from the signal output circuit 15 in such a state that the distortion in the wave form has been removed and the wave form has been commutated.

[0044]

As described above, by setting the control signal to be outputted to Vcc when the control signal for PWM to be inputted is at an H-level and to 0 when the control signal for PWM to be inputted is at an L-level, the distortion of the control signal to be outputted will be removed even though distortion is caused in the control signal due to, for example, non-linearity of a transfer element or floating capacity of a signal line and the like. As a result, the control signal can be stable even agaist disturbing noises, and the length of the signal line for connecting the next charging lamp lighting apparatus 1 may be made longer.

[0045]

Now, still the other embodiment will be explained in the following with referring to FIG. 4.

[0046]

The charging lamp lighting apparatus shown in FIG. 4 is configured such that, in the charging lamp lighting apparatus shown in FIG. 1, an abnormality detection means 18 is provided in the signal output circuit 15, a shunt resistance R11 is connected to between a collector of the transistor Q5 and an emitter of the phototransistor Q4 in the abnormality detection means 18, a Zener diode ZD2 and a relay coil RyL1 of a relay Ry1 are connected to the shunt resistance R11, and the relay contact point Ry1S1 of the relay Ry1 is connected to a base of the transistor Q5.

[0047]

The basic operation in this embodiment is similar to that in the charging lamp lighting apparatus shown in FIG. 1. That is, when an excess current such as a short circuit current flows into a signal line of the signal output circuit 15, the voltage of the shunt resistance R11 is increased to thereby turn the Zener diode ZD2 on, the current flows into the relay coil Ry1L to open the relay contact point Ry1S1, the transistor Q5 is kept turned off, and no signal is outputted from the signal output circuit 15 even when a control signal is inputted to the signal input circuit 9.

[0048]

Accordingly, an output of the control signal is discontinued when an excess current such as a short circuit current flows to the input side due to, for example, a wiring

work, or abnormality or excess connections in the circuit of the charging lamp lighting apparatus 1 so that the next charging lamp lighting apparatus, etc. can be protected from the excess current. Furthermore, when there is an abnormality in the next charging lamp lighting apparatus 1 or in the signal line to the next charging lamp lighting apparatus, no control signal is outputted. As a result, determination of the abnormal point can be facilitated.

[0049]

Now, still the other embodiment will be explained in the following with referring to FIG. 5.

[0050]

The charging lamp lighting apparatus shown in FIG. 5 is configured such that, in the charging lamp lighting apparatus shown in FIG. 4, a relay coil Ry1L2 to be operated by the relay coil Ry1L is connected to between the Vref terminal and PWM terminal of the microcomputer 8 and a fluorescent lamp functions as an informing means.

[0051]

Then, when an excess current, etc. is detected in the shunt resistance R11, the output of the control signal is discontinued, and a short circuit is caused between the Vref terminal and PWM terminal of the microcomputer 8 to discontinue the operation of the inverter circuit 4 at the same time. Since lighting of a fluorescent lamp is extinguished by the discontinuance of the operation of the inverter circuit 4 as described above, it is easy to recognize such an abnormality.

[0052]

Now, still the other embodiment will be explained in the

following with referring to FIG. 6.

[0053]

The charging lamp lighting apparatus shown in FIG. 6 is configured such that, in the charging lamp lighting apparatus shown in FIG. 4, a series circuit consisting of a timer circuit 19 and a relay coil Ry2L of a relay Ry2 is connected in parallel to the relay coil Ry1L, a relay contact point Ry2S is connected to between the Vref terminal and PWM terminal of the microcomputer 8, and a fluorescent lamp functions as an informing means.

[0054]

Then, when an excess current, etc. is detected in the shunt resistance R11, the output of the control signal is discontinued, currents are applied to the relay coil Ry2L by the timer circuit 19 to thereby cause a short circuit between the Vref terminal and PWM terminal of the microcomputer 8 at every prefixed time interval so that the operation of the inverter circuit 4 is discontinued at every prefixed time interval. Since lighting of a fluorescent lamp is extinguished by the discontinuance of the operation of the inverter circuit 4 at every prefixed time interval as described above, it is easy to recognize such an abnormality.

[0055]

[Advantageous Effects of the Invention]

With the electric power source apparatus as defined in claim 1, since an output from the power conversion means can be changed by the control signal having been inputted to the signal input means and a control signal corresponding to the former control signal is outputted from the signal output means

via the buffer means at the same time, it is needless to increase the current intensity for the control signal, and, since the length of the signal line for connection to be used for one apparatus can be shortened, for example, it is possible to prevent distortion in the signals and adverse influence due to, for example, resistance of the signal line from being caused and to ensure the control by means of the control signal.

[0056]

With the electric power source apparatus as defined in claim 2, since the signal output means includes the output wave form commutation means additionally to the electric power source apparatus as defined in claim 1 so that the outputted wave form of the control signal is commutated by the output wave form commutation means, it is possible to make the control signal accurate and to ensure the control by means of the control signal.

[0057]

With the electric power source apparatus as defined in claim 3, since, in addition to the electric power source apparatuses as defined in claims 1 and 2, the control signal outputted from the signal output means is discontinued by the discontinuing means when an abnormality is detected by the abnormality detection means, it is possible to prevent the apparatus from being operated under an abnormal state.

[0058]

With the electric power source apparatus as defined in claim 4, since, in addition to the electric power source apparatus as defined in claim 3, an informing means for informing an abnormality when an abnormality is detected by the abnormality detection means is included, it is possible to recognize an

abnormality upon arising of the abnormality by means of the informing means.

[0059]

With the electric power source apparatus as defined in claim 5, since, in addition to the electric power source apparatus as defined in claim 4, the load circuit includes a lamp and the informing means causes the lamp to lighten it in a different manner from the normal lighting manner, it is possible to recognize an abnormality with the lamp in the load circuit.

[Brief Explanation of the Drawings]

[FIG. 1] A circuit diagram showing the configuration of a charging lamp lighting apparatus according to an embodiment for the present invention;

[FIG. 2] A circuit diagram showing the connections in the charging lamp lighting apparatus shown in FIG. 1;

[FIG. 3] A circuit diagram showing the configuration of a charging lamp lighting apparatus according to the other embodiment for the present invention;

[FIG. 4] A circuit diagram showing the configuration of a charging lamp lighting apparatus according to still the other embodiment for the present invention;

[FIG. 5] A circuit diagram showing the configuration of a charging lamp lighting apparatus according to still the other embodiment for the present invention;

[FIG. 6] A circuit diagram showing the configuration of a charging lamp lighting apparatus according to still the other embodiment for the present invention;

[FIG. 7] A circuit diagram showing the configuration of a conventional charging lamp lighting apparatus;

[FIG. 8] A circuit diagram showing the connections in the conventional charging lamp lighting apparatus shown in FIG. 7; and

[FIG. 9] A circuit diagram showing the connections in the other conventional charging lamp lighting apparatus.

[Explanation for Reference signs]

4: Inverter circuit as a power conversion means

9: Signal input circuit as a signal input means

15: Signal output circuit as a signal output means

16: Buffer circuit as a buffer means

17: Comparator as an output wave form commutation means

18: Abnormality detection means

FL: Fluorescent lamp as a charging lamp

Ry1S1: Relay contact point as a discontinuing means